

FILE




Washington State  
Department of Transportation

## Memorandum

May 16, 2005

TO: M. Gribner / B. Westby  
Eastern Region Design Office

FROM:  T. Allen / M.A. Frye  
EEP Geotechnical Division MS: 47365  
Fax (360) 709-5585

SUBJECT: SR 395, C.S. 3208, XL-2201  
NSLAC – Francis Avenue to US 2 Structures  
Retaining Wall Recommendations

### Introduction

This memorandum presents geotechnical recommendations for the retaining walls necessary to transition from approach fills to the US 395 Northbound Overcrossing at Fairview Road, the US 395 Northbound Overcrossing at Market Street, the US 395 Northbound Overcrossing at Parksmith Drive/BNSF, and the US 395 Undercrossing at Perry Street. This memorandum is a supplement to our April 8, 2005 Geotechnical Report titled, *SR 395 – NSLAC – Francis Avenue to US 2 Structures*.

We understand the proposed walls will be fill walls supporting either the northbound lanes of SR 395 or surface streets. A vicinity map of the project is provided on Figure 1. The locations of the walls are shown on Figures 2, 3, 4, and 5. Table 1 summarizes the wall designations, locations, and exposed heights. If the location, height, or alignment of these walls changes significantly prior to construction, we should be notified so we can reevaluate our recommendations and provide assistance. A significant change would include an increase in height of more than 5 feet, an increase in length of more than 25 feet, or change in location of the wall (with respect to the centerline alignment) of more than 25 feet.

The analysis, conclusions, and recommendations provided in this memorandum are based on our understanding of the project and site conditions existing at the time of our site review and field exploration program. The exploratory borings are assumed to be representative of the subsurface conditions at locations throughout the site. If during

construction, subsurface conditions differ from those described in the explorations, we should be advised immediately so that we may reevaluate our recommendations and provide assistance.

**Table 1: Retaining Wall Locations and Heights**

Wall	Location	Height
FV Wall 1	LR 340+39.56 (34' Rt.) to LR 340+74.56 (34' Rt.)	12.0'
FV Wall 2	LR 342+33.77 (34' Rt.) to LR 342+49.77 (34' Rt.)	7.4'
FV Wall 3	LR 339+95.88 (22' Lt.) to LR 340+38.88 (22' Lt.)	15.2'
FV Wall 4	LR 341+98.09 (22' Lt.) to LR 342+22.09 (22' Lt.)	10.8'
MK Wall 1	PK S-EW 8+62.03 (43' Rt.) to PK S-EW 9+24.03 (43' Rt.)	19.0'
MK Wall 2	PK S-EW 10+89.08 (43' Rt.) to PK S-EW 11+34.08 (43' Rt.)	15.5'
MK Wall 3	LR 375+67.73 (22' Lt.) to LR 376+44.73 (22' Lt.)	24.1'
MK Wall 4	LR 378+02.36 (22' Lt.) to LR 378+47.36 (22' Lt.)	16.5'
PK Wall 1	PK EW-N 25+20.61 (43' Rt.) to PK EW-N 25+38.61 (43' Rt.)	3.7'
PK Wall 2	LR 395+72.00 (77.03' Rt.) to LR 395+90.00 (76.67' Rt.)	7.8'
PK Wall 3	LR 392+85 (22' Lt.) to LR 393+03 (18' Lt.)	8.8'
PK Wall 4	LR 395+72 (22' Lt.) to LR 395+90 (22' Lt.)	6.9'
PY Wall 1	PY 12+09 (24' Rt.) to PY 12+48 (24' Rt.)	17.8'
PY Wall 2	PY 15+52 (24' Rt.) to PY 15+87 (24' Rt.)	15.4'
PY Wall 3	PY 12+09 (24' Lt.) to PY 12+48 (24' Lt.)	19.5'
PY Wall 4	PY 15+52 (24' Lt.) to PY 15+87 (24' Lt.)	16.0'

## Project Description

The NSLAC project is located in northeast Spokane, between the Spokane River Bridge and the Little Spokane River. The project will entail construction of approximately nine miles of new, four to eight lane highway, up to seven interchanges, and their associated structures. The purpose of the project is to improve mobility through the city of Spokane and Spokane County between Interstate 90 (I-90), US 2, northeastern Washington, and Canada.

The project is divided into a number of sections for the purpose of design and construction. The Francis Avenue to US 2 Structures project will construct a series of bridges between Gerlach Road and Perry Street. This memorandum provides retaining wall recommendations for 16 walls necessary to transition from approach fills to four bridges associated with this phase of the project.

## Field Exploration, Laboratory Investigation, and Subsurface Conditions

Our field exploration and laboratory investigation for this project is described in our April 8, 2005 report. No additional exploration or testing was conducted for the design

of the walls discussed in this memorandum. Site geology, site soils, and groundwater are discussed in our previous report. The boring logs provided in our April 8<sup>th</sup> report should be included in the contract documents.

## Geotechnical Recommendations

### Geosynthetic Walls

We understand your office would prefer to use Standard Plan D-3 Geosynthetic Walls for this project. Geosynthetic walls are suitable and can be used for all of the walls listed in Table 1. The Type 4 Wall shown in Standard Plan D-3 provides adequate reinforcing length to meet required factors of safety for bearing capacity, sliding, overturning, and global stability. Settlements are anticipated to be less than 1 inch, and occur during construction. Post-construction settlement will be negligible.

### Structural Earth Walls

Proprietary structural earth (SE) walls that have been pre-approved by WSDOT are also suitable for these walls. Design parameters for inclusion in the General Special Provision titled *Structural Earth Walls*, are as follows:

<u>Soil Parameters</u>	<u>Wall Backfill</u>	<u>Retained Soil</u>	<u>Foundation Soil</u>
Unit Weight (pcf)	130	125	125
Friction Angle (deg)	36	36	34
Cohesion (psf)	0	0	0

<u>Foundation Soil</u>	<u>AASHTO Load Group I</u>	<u>AASHTO Load Group VII</u>
Allowable Bearing Capacity (psf)	7,000	14,000
Acceleration Coefficient (g)	0	0.06

A traffic surcharge of 250 psf should be added when designing the wall.

The SE wall system should meet the following requirements.

1. The wall should be placed on a level (in direction perpendicular to the wall face) and firm foundation. Walls can be allowed to slope along their length up to 4H:1V (horizontal:vertical) or be stepped in accordance with the manufacturers recommendations to match a steeper slope.
2. Wall face batter should be no steeper than 1H:48V.
3. The base width of the wall should be greater than or equal to **70 percent** of the wall height.
4. The top reinforcing layer should be placed no lower than 2 feet below the top of the wall.

5. Wall embedment should be at least 2 feet or 10 percent of the wall height, whichever is greater.
6. Provisions for permanent control of subsurface water behind the wall should consist of a slotted drain pipe embedded in Gravel Backfill for Drains (Section 9-03.12(4)) as shown in Design Manual Figure 1130-2.
7. Drainage structures should be located outside the reinforced zone where possible. If drainage structures are planned within the reinforced zone, they must be shown on the plans and profile sheets provided to the wall proprietor so they can account for the structures in their design. If drainage structures are located behind the face of a SE wall, the outfall pipe should run perpendicular to the wall face.

Settlements are anticipated to be less than 1 inch, and occur during construction. Post-construction settlement will be negligible.

Prior to contract advertisement, the Project office should contact each of the wall proprietors listed in the General Special Provisions to confirm that they want to be included in the contract.

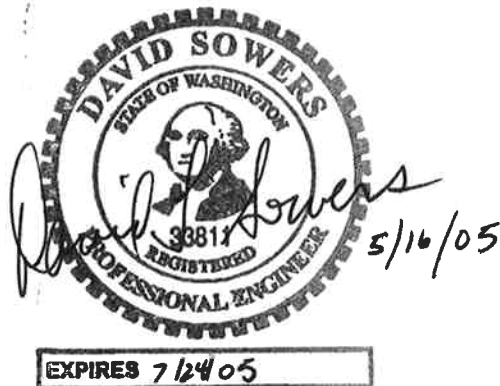
## Construction Considerations

Where drainage structures are located within the reinforcing of a geosynthetic wall, the reinforcing should be close cut to fit around the structure. If the pipe diameter exceeds the reinforcement spacing, the reinforcing can be adjusted to fit around the pipe. A minimum of one inch of backfill should be maintained between the pipe and the reinforcing. Reinforcing layers should not be cut to accommodate drainage pipes.

If you have questions or require further information, please contact Mark Frye at (360) 709-5469 or Tony Allen at (360) 709-5450.



Designed By: Mark A. Frye  
Geotechnical Engineer

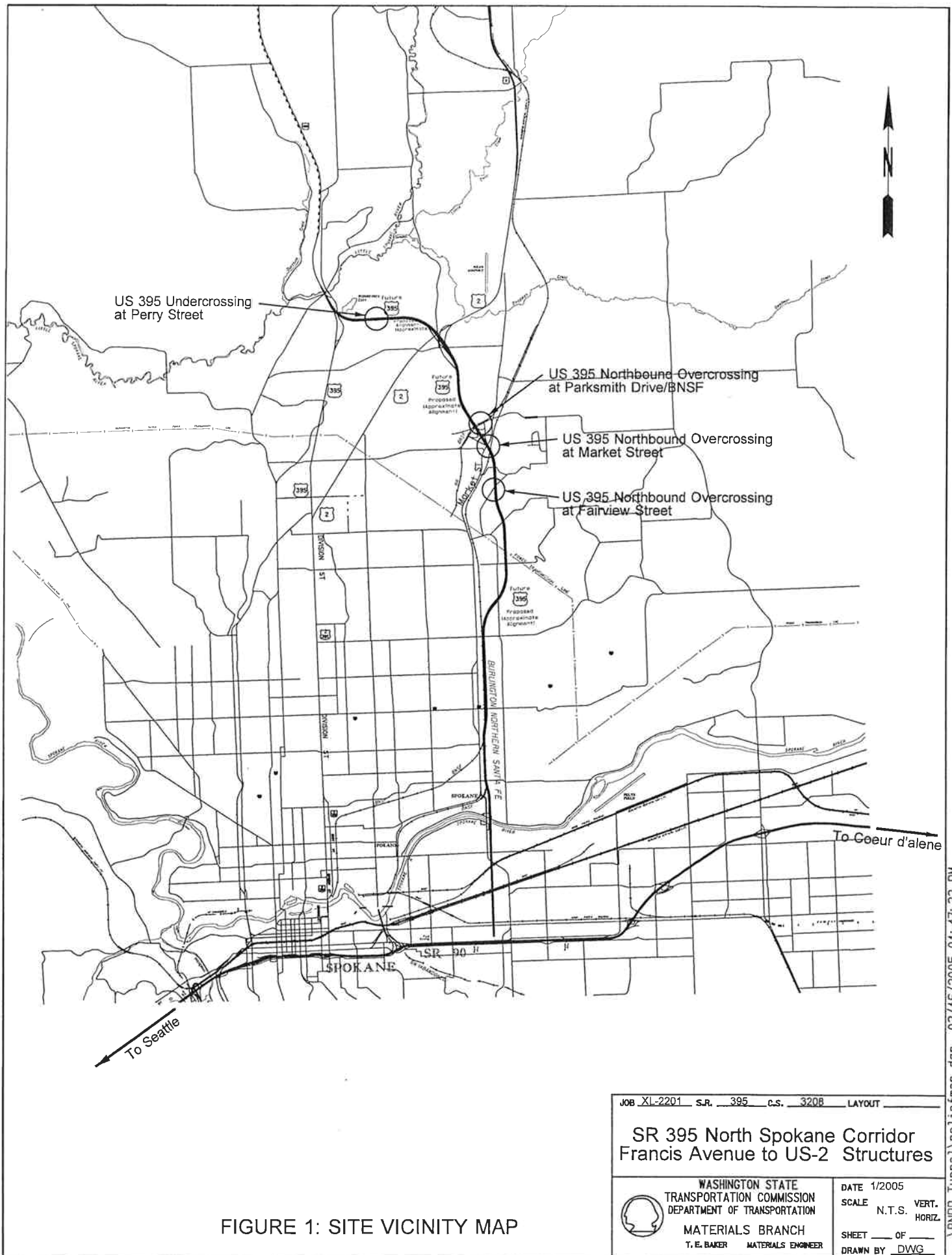


Reviewed By: David Sowers  
Senior Geotechnical Engineer

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TMA/maf  
Attachments: Figures

cc: Richard Zeldenrust, Bridge and Structures, MS47340  
Gion Gibson, Eastern Region Materials Engineer



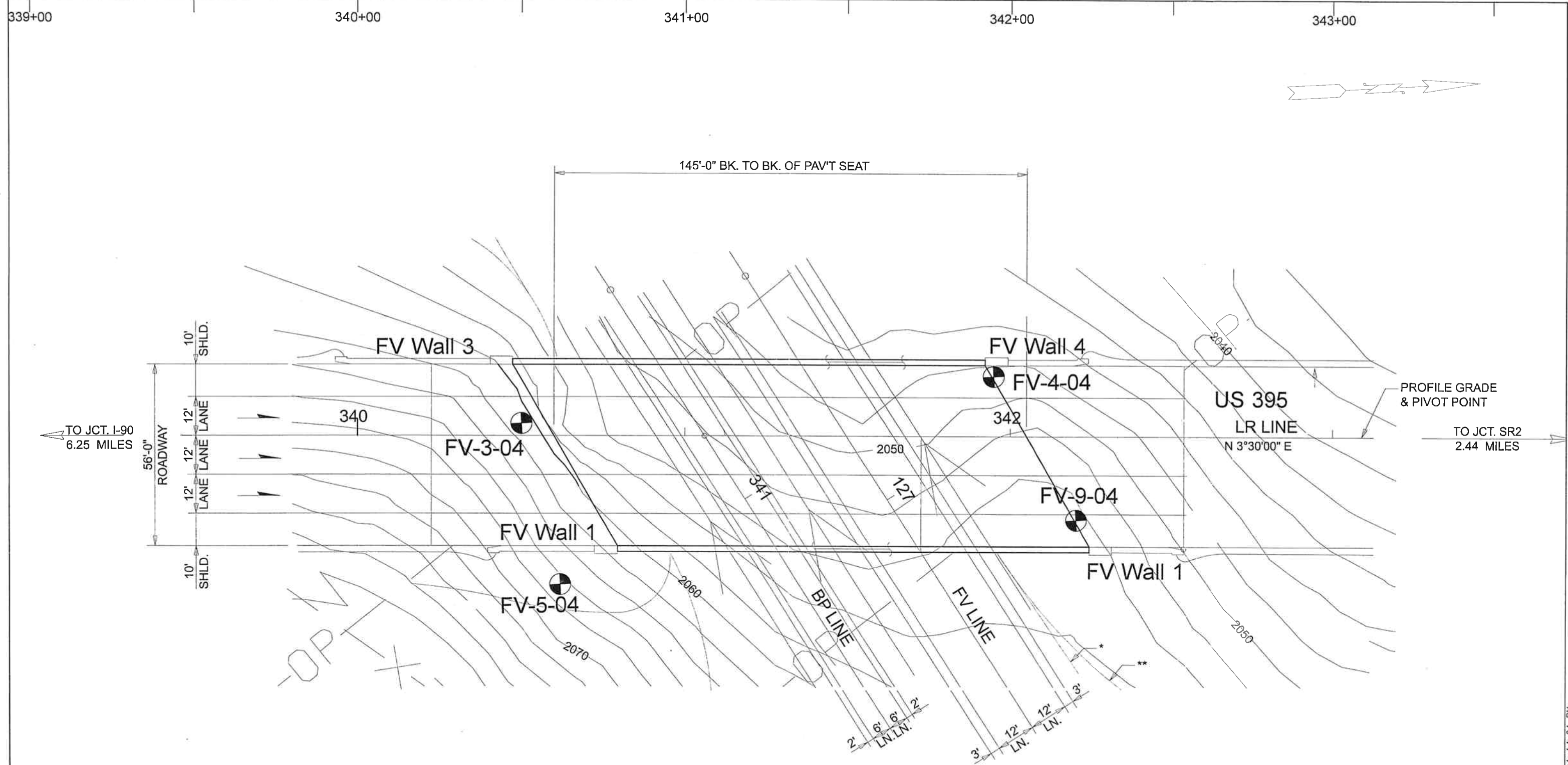

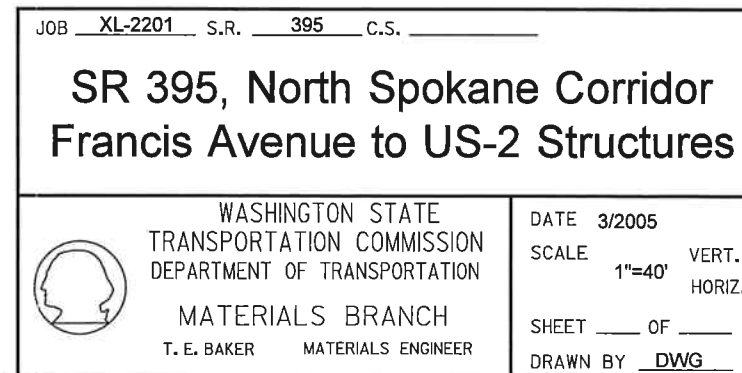


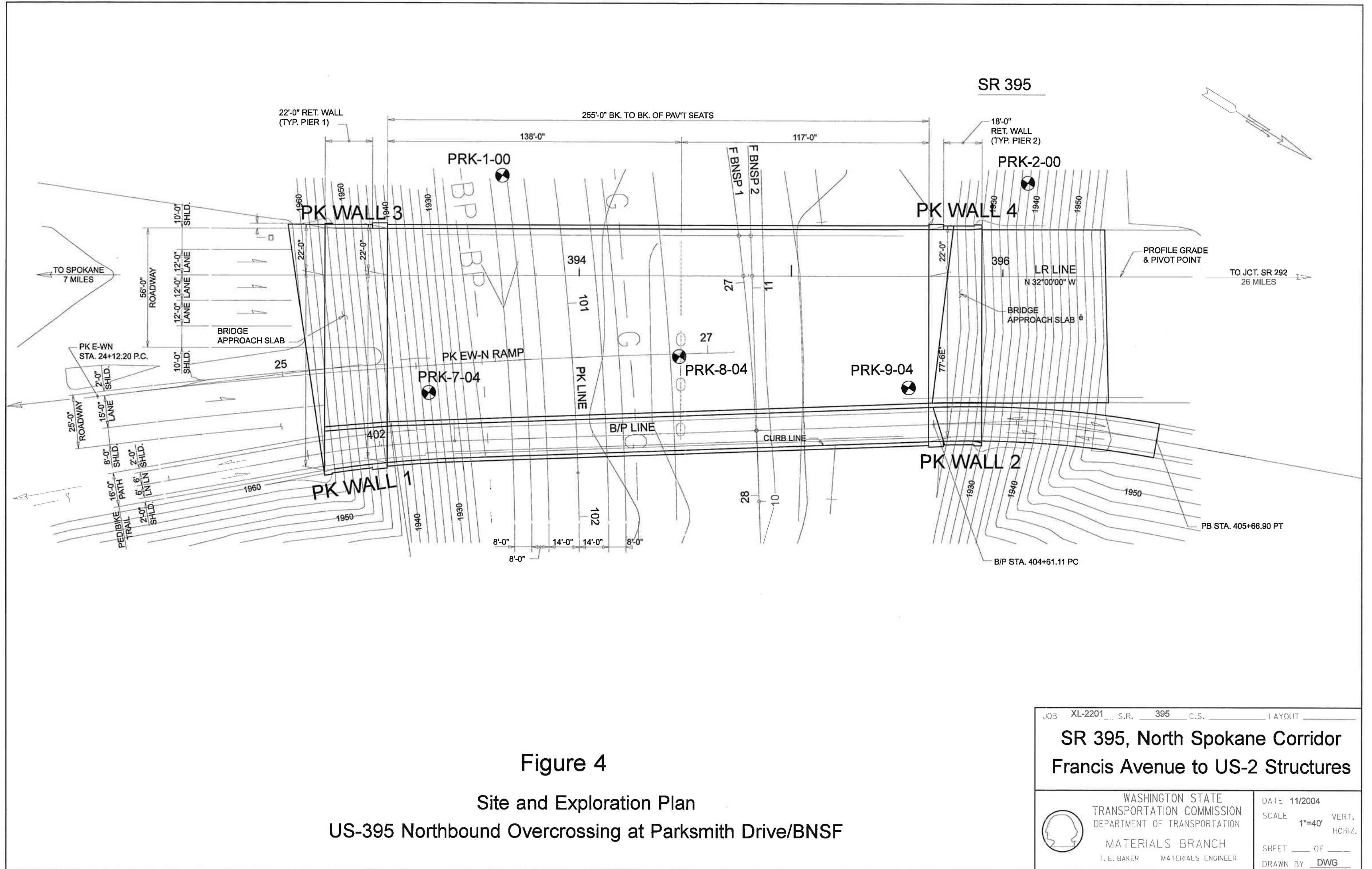
Figure 2  
Site and Exploration Plan  
US-395 Northbound Overcrossing at Fairview Road

JOB XL-2201 S.R. 395 C.S. LAYOUT	
SR 395, North Spokane Corridor Francis Avenue to US-2 Structures	
 WASHINGTON STATE TRANSPORTATION COMMISSION DEPARTMENT OF TRANSPORTATION MATERIALS BRANCH T. E. BAKER MATERIALS ENGINEER	DATE 11/2004 SCALE 1"=30' VERT. HORIZ. SHEET OF DRAWN BY DWG



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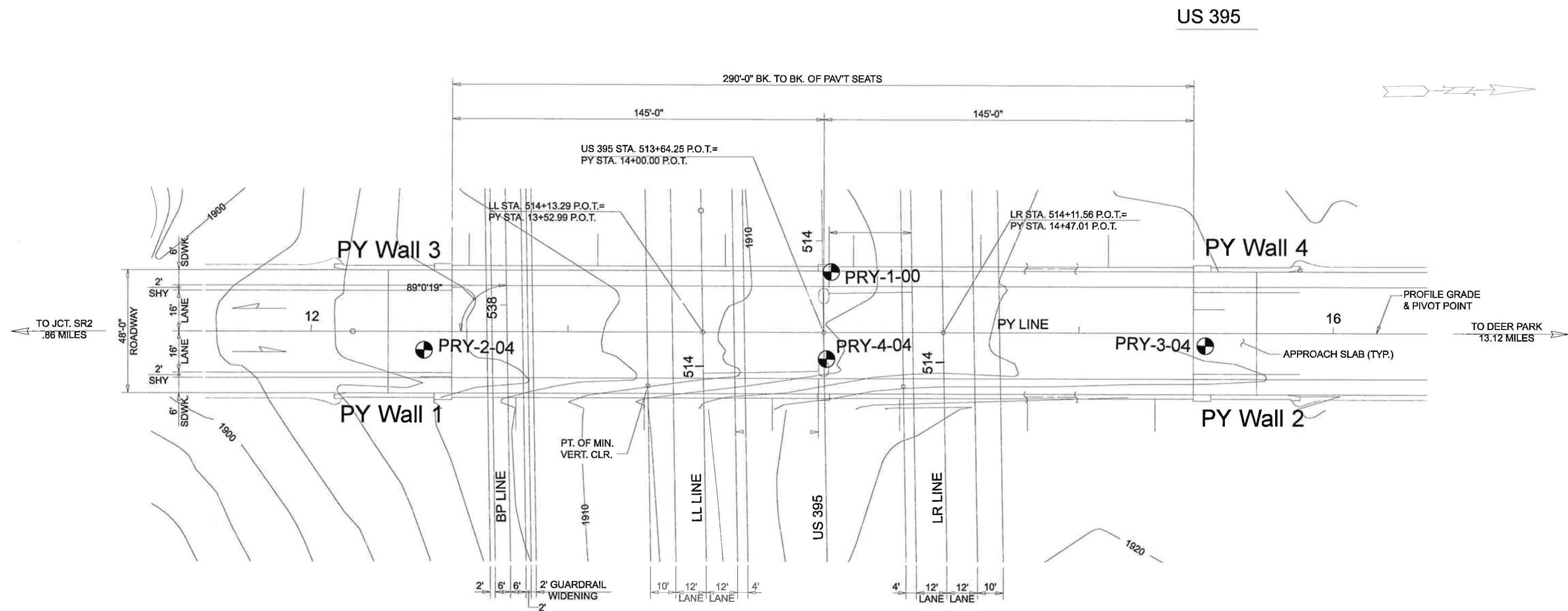



Figure 5

Site and Exploration Plan

US-395 Undercrossing at Perry Street

JOB XL-2201 S.R. 395 C.S. LAYOUT	
SR 395, North Spokane Corridor Francis Avenue to US-2 Structures	
 WASHINGTON STATE TRANSPORTATION COMMISSION DEPARTMENT OF TRANSPORTATION MATERIALS BRANCH T. E. BAKER MATERIALS ENGINEER	DATE 11/2004 SCALE 1"=40' VERT. HORIZ. SHEET ____ OF ____ DRAWN BY DWG